

Novel, Vacuum-Regenerable Trace Contaminant Control System for Advanced Spacesuit Applications, Phase II

Completed Technology Project (2017 - 2021)

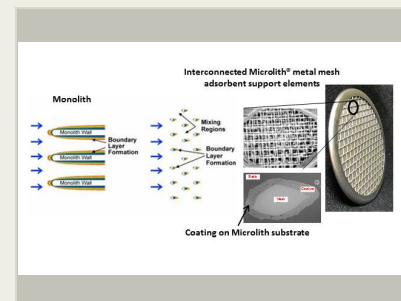


Project Introduction

Precision Combustion, Inc. (PCI) proposes a new material paradigm for the Trace Contaminant Control System (TCCS) based upon its novel adsorbent nanomaterials that have high surface area and can be designed to achieve uniquely-targeted sorbent properties, including increasing affinity to remove specific contaminants, minimizing competitive sorption with water and CO₂, and achieving vacuum regeneration without heating. This breakthrough enables a compact, low pressure drop, and vacuum-regenerable TCC device for efficient removal of NH₃ and CH₂O, thus offering the potential for real-time, on-the-suit sorbent regeneration, reduced logistical burden associated with bed replacement or thermal regeneration, and further volume and weight reduction of the TCCS module. In Phase I, all objectives and proposed tasks were successfully completed to demonstrate proof-of-concept of vacuum-regenerable sorbent materials to permit a compact, efficient TCCS. In Phase II, we will build on Phase I success to develop, fabricate, and demonstrate a compact, low pressure drop, vacuum-regenerable TCCS hardware prototypes for efficient removal of NH₃ and CH₂O to meet NASA requirements. This effort would be valuable to NASA as it would significantly reduce the current PLSS technical risks and increase mission capability/durability/efficiency while at the same time increasing the TRL of the novel vacuum regenerable TCCS.

Anticipated Benefits

Targeted NASA applications will be in advanced spacesuit PLSS with key potential customers include Lyndon B. Johnson Space Center, Marshall Space Flight Center. This TCCS device will have additional applications in other NASA projects such as spacecraft and ISS atmosphere revitalization or future ISRU concepts for Lunar or Martian bases. A significant non-NASA application for this technology is in indoor air quality improvement in buildings. Primary applications will be for buildings where Volatile Organic Compounds (VOCs) or other gaseous air contaminants control is desired, with particular emphasis on new buildings, buildings where occupants claim to suffer from sick building syndrome, and green buildings where HVAC energy costs are a large concern. A primary economic driver of interest will be the ability to reduce and minimize HVAC operating costs for building air in reducing the amount of make-up conditioned outdoor air required. Additional targeted spin-off applications relate to commercial aircraft air purification, where the compact size, low weight, durability, and increased operating time of the sub-systems can bring value, or for military vehicle cabins, such as in aircraft, ships, and submarines.



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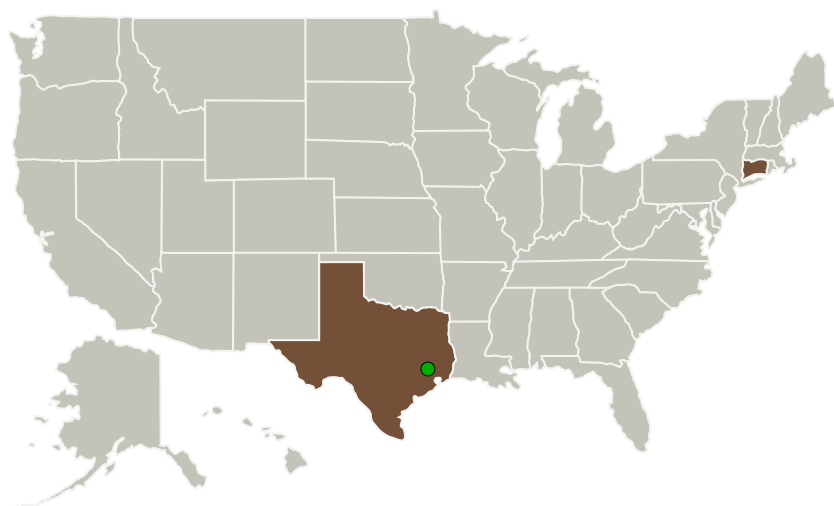
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Primary U.S. Work Locations and Key Partners



| Organizations Performing Work | Role | Type | Location |
|-------------------------------|-------------------------|-------------|--------------------------|
| Precision Combustion, Inc. | Lead Organization | Industry | North Haven, Connecticut |
| ● Johnson Space Center(JSC) | Supporting Organization | NASA Center | Houston, Texas |

Primary U.S. Work Locations

| | |
|-------------|-------|
| Connecticut | Texas |
|-------------|-------|

Project Transitions

▶ **April 2017:** Project Start

✓ **February 2021:** Closed out

Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/141052>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Precision Combustion, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Project Managers:

John C Graf
Kathryn B Packard

Principal Investigator:

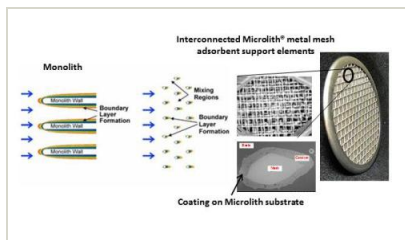
Christian Junaedi

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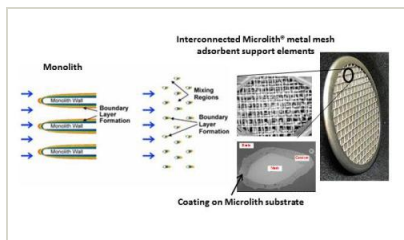


Images



Briefing Chart Image

Novel, Vacuum-Regenerable Trace Contaminant Control System for Advanced Spacesuit Applications, Phase II Briefing Chart Image (<https://techport.nasa.gov/image/130746>)

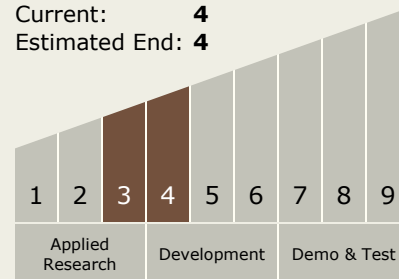


Final Summary Chart Image

Novel, Vacuum-Regenerable Trace Contaminant Control System for Advanced Spacesuit Applications, Phase II (<https://techport.nasa.gov/image/133682>)

Technology Maturity (TRL)

Start: **3**
Current: **4**
Estimated End: **4**



Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System